AD-A093 210 YALE UNIV NEW HAVEN CT DEPT OF PSYCHOLOGY F/G 5/10
THE NATURE OF INTELLIGENCE.(U)
OCT 80 R J STERNBERG N00014-78-C-0025
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The Nature of Intelligence

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Technical Report No. 27
October, 1980

This research was sponsored by the Personnel and
Training Research Programs, Psychological Sciences
Division, Office of Naval Research, under Contract
No. N0001478C0025, Contract Authority Identification
Number NR 150-412.

Research rept. 1 Jul - 30 Sep 80

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER Technical Report No. 27	2. GOVT ACCESSION NO. AD-A093 210	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) The Nature of Intelligence		5. TYPE OF REPORT & PERIOD COVERED Periodic Technical Report (1 Jul 80 - 30 Sep 80)
		6. PERFORMING ORG. REPORT NUMBER Research Report No. 6-80
7. AUTHOR(s) Robert J. Sternberg		8. CONTRACT OR GRANT NUMBER(s) N0001478C0025 N00014-78-C-0025
9. PERFORMING ORGANIZATION NAME AND ADDRESS Department of Psychology Yale University New Haven, Connecticut 06520		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 61153N; RR 042-04; RR 042-04-01; NR 150-412
11. CONTROLLING OFFICE NAME AND ADDRESS Personnel and Training Research Programs Office of Naval Research (Code 458) Arlington, Virginia 22217		12. REPORT DATE 1 Oct 80
		13. NUMBER OF PAGES 22
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) RR-6-80, TR-27		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited

RR04204 RR0420401

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

New York University Education Quarterly, in press

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Intelligence, macrocomponents, microcomponents

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This article discusses the nature of intelligence, introducing a new distinction between macrocomponents and microcomponents of human intelli[gence]. Macrocomponents are the global-level constellations of processes that ar[e] formed from concatenations of microcomponents, and include general, acade[mic], practical, crystallized, and fluid intelligence, as well as motivation. Microcomponents are fairly elementary operations such as inference and [appli]cation of analogical relations. The article considers what the macroc[omponents ...] - over

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S/N 0102-LF-014-6601

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ponents and microcomponents of intelligence are, and examines the extent to which IQ tests measure these components.

The Nature of Intelligence

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The Nature of Intelligence

A storm of controversy has descended upon the once placid IQ-testing establishment. If we are to seek a nontrivial understanding of the relationship between natural intelligence on the one hand, and measured intelligence (IQ) on the other, there is one route to solution that will clearly not lead us to the heart of the problem, and that we must avoid at all costs. This is the route in which one defines away (rather than defines) intelligence as whatever it is that IQ tests measure.

Like other investigators in the field of intelligence, I have my own preferred bag of tricks for studying intelligent functioning. I believe my methods have worked rather well, and I will certainly share the major details of some of these methods with you. But I do not claim that they, and they alone, can tell us the true nature of intelligence. Instead, I am prepared to make an even more daring claim, namely, that most of the analytic methods for studying intelligence that have been used have told us a fair amount about the nature of intelligence, and that a careful examination of their findings reveals a common core of generalizations. The fact that this common core exists essentially independently of the method of analysis used convinces me that we need not turn in despair to operational definitions, because we can make some generalizations about the nature of intelligence that are not idiosyncratic to the methodological or theoretical preferences of any particular school of thought. Let us consider now what four of these schools of thought are, some findings that have emerged from them, and how these findings generalize across the various schools.

Definitions of Intelligence

One approach to understanding what intelligence is involves simply asking people to define it (in a nontrivial way). Usually, these people are experts. The most famous example of this approach in action can be found in "Intelligence

and its Measurement," a symposium in which the editors of the Journal of Educational Psychology asked experts in the field of intelligence to indicate what they conceive 'intelligence' to be." (1) Fourteen experts responded, and although the symposium was presented way back in 1921, one might speculate that similar kinds of responses would be obtained from experts today. The definitions included (a) the power of good responses from the point of view of truth or fact (E. L. Thorndike); (b) the ability to carry on abstract thinking (L. M. Terman); (c) having learned or ability to learn to adjust oneself to the environment (S. S. Colvin); (d) ability to adapt oneself adequately to relatively new situations in life (R. Pintner); (e) the capacity for knowledge and knowledge possessed (V. A. C. Henmon); (f) a biological mechanism by which the effects of a complexity of stimuli are brought together and given a somewhat unified effect in behavior (J. Peterson); (g) the capacity to inhibit an instinctive adjustment, the capacity to redefine the inhibited adjustment in the light of imaginally experienced trial and error, and the volitional capacity to realize the modified instinctive adjustment into overt behavior to the advantage of the individual as a social animal (L. L. Thurstone); (h) the capacity to acquire capacity (H. Woodrow); and (i) the capacity to learn or to profit by experience (W. F. Dearborn). The other experts did not answer the question directly.

Viewed narrowly, there seem to be as many definitions of intelligence as there were experts asked to define intelligence. Viewed broadly, however, at least three themes seem to run through many of these definitions. One theme is the ability to learn or profit from experience, and the knowledge actually acquired in this way; a second theme is real-world problem solving of the kind needed for adaptation to the vagaries of an uncertain and changing environment; and a third theme is abstract thinking or reasoning ability, such as that required in integrating information from a variety of diverse sources. There is also a hint in some of these definitions, particularly in that of Thurstone, and in the text of the symposium as a whole, [illegible]

a motivational component in intelligence. In Thurstone's conceptualization, the intelligent organism is one with the volitional capacity to translate the products of the mind into actions that benefit the organism in its social milieu.

I noted above the possibility one might speculate that similar kinds of responses might be obtained from the experts of today. In fact, some colleagues and I at Yale conducted a survey by mail in which experts in the field of intelligence were asked to rate (on a 1 to 9 scale) either how important each of 158 behaviors is in defining their conception of an "ideally intelligent person," or how characteristic each of these behaviors is in the behavioral repertoire of such a person. (2) We used the statistical technique of factor analysis to identify the main constellations of behaviors that emerged from the responses of the 142 experts who replied. Factor analysis groups into constellations, or factors, ratings or scores that are highly related to (i.e., correlated with) each other, and separates ratings or scores that are only weakly related. Three such constellations emerged. The first, which we labeled "verbal intelligence," included general learning and comprehension abilities, as well as the knowledge gleaned from them. Examples of behaviors entering into this factor were "displays a good vocabulary," "reads with high comprehension," "is intellectually curious," "learns rapidly," "converses easily on a variety of subjects," and "reads widely." The second constellation, which we labeled "problem solving ability," included behaviors of the kind that might be viewed as involving abstract thinking or reasoning in the integration of information, for example, "able to apply knowledge to problems at hand," "poses problems in an optimal way," "solves problems well," "plans ahead," "gets to the heart of problems," "considers the end result of actions," and "approaches problems thoughtfully." The third constellation, which we labeled "practical intelligence," included real-world adaptive behaviors such as "sizes up situations well," "determines how to achieve goals," "displays awareness to the world around him or her,"

"displays interest in the world at large." Although I would not claim that these three factors coincide exactly with the three themes identified in a different way at a different time with different experts participating in the 1921 symposium, there is an apparent and I believe striking convergence in the abilities that were identified. The motivational component that seemed to run through some of the earlier responses also seems to run through some of the more recent ones, if anything, even more forcefully.

Even more striking, perhaps, than the convergence in views between the experts of yesterday and those of today is the convergence in views between the experts and laypeople of our own time. When the same survey that was given to the experts was given to a general sample of adults (nonstudents) in the New Haven area who answered a newspaper advertisement to participate in a psychology experiment, the correlations between the responses of the experts and the laypeople were almost as high as the reliabilities of the respective sets of responses would permit, both for the ratings of importance and for the ratings of characteristicness. Although the experts in our sample all had received doctoral degrees in psychology, were all employed at major colleges or universities, and had all published major research in the field of intelligence, their conceptions of intelligence differed hardly at all from the conceptions of the general adult population.

Factors of Intelligence

In the study of experts' and laypersons' conceptions of intelligence mentioned above, my colleagues and I factor analyzed people's ratings of behaviors that might be labelled "intelligent." A more conventional use of factor analysis, however, is in the analysis of the actual behaviors themselves. For example, an investigator might factor analyze patterns of correlations between scores on a large number of ability tests, looking for constellations of test scores that are highly related to each other, and hoping thereby to discover the

latent sources of individual differences that are hypothesized to generate observable differences in scores on the tests.

A number of different factorial theories of intelligence have been proposed, each based upon factor analyses of various kinds of mental-ability tests. Investigators usually propose or select among factorial theories on the bases of criteria such as psychological plausibility, parsimony, statistical goodness of fit, and the like.

The earliest factorial theory of the nature of intelligence was formulated by the inventor of factor analysis, Charles Spearman. (3) Spearman's analysis of relations among the kinds of mental tests he and other psychologists had been administering led him to propose what he inappropriately called a "two-factor" theory of intelligence. According to this theory, intelligence comprises two kinds of factors (rather than just two factors)--a general factor and specific factors. General ability, or "g," as measured by the general factor, is required for performance on mental tests of all kinds. Each specific ability, as measured by each specific factor, is required for performance on just one kind of mental test. Because there are as many specific factors as there are tests, specific factors are wholly unparsimonious, i.e., fail to provide any reduction of the data, and hence are of little interest. There is only a single general factor, however, making this factor of considerable interest.

As might be expected, the attempt to account for what is interesting in intelligent behavior via just a single factor proved to be too parsimonious for the tastes of most theorists: the single factor just didn't account for enough of the variation in different individuals' scores to render it a reasonably complete explanation of intelligence. More recent theorists have subdivided the general factor into two or more subfactors, and, interestingly, there seems to be rather broad agreement among contemporary factor theorists as to what at least two of these sub-

factors should be. They are what have been called "crystallized" and "fluid" abilities by Cattell, Horn, and their followers, and "verbal-educational" and "practical-mechanical" abilities by Vernon and his followers. (4) The corresponding abilities match very closely for two different theories proposed by two different research groups. No investigators, including the present ones, would claim that these are the only subfactors that might be identified, or that these subfactors could not be subdivided further. To the contrary, most contemporary factor theorists accept a hierarchical model of intelligence whereby further subdivisions are an integral part of their theories. What is striking, rather, is that a large number of investigators find this particular division to be a plausible, *although partial, one.*

In the Cattell-Horn terminology, crystallized ability includes the knowledge and skills measured by tests of vocabulary, general information, and reading comprehension. To a large extent, then, it represents the extent of a person's acculturation, both in terms of the outcomes of acculturation (vocabulary, general information) and the processes of acculturation (reading comprehension). Stated in another way, it may be viewed as a person's ability to learn or profit from experience, and the knowledge actually acquired in this way. When viewed in this way, "crystallized ability" is a label for one of the three themes that ran through the definitions of intelligence considered earlier. Fluid ability includes the skills and knowledge measured by abstract reasoning tests such as figural analogies (requiring individuals to indicate which of several answer options is related to a C term in the same way that a B term is related to an A term), figural series completions (requiring individuals to indicate which of several answer options completes a geometric progression), and figural classifications (requiring individuals to indicate which of several answer options is most similar to several given geometric figures). Fluid ability may be viewed as a person's ability to think and reason abstractly, another one of the themes that ran through the definitions of intelligence considered earlier.

There is nothing in the Cattell-Horn or Vernon theories that corresponds to the theme of practical problem-solving or adaptational ability. Indeed, although some investigators, such as Guilford, have included one or more factors of practical intelligence in their theories, the search for a replicable factor of practical or social intelligence that appears in multiple investigations has been an elusive one. (5) The motivational component that ran through the definitions of intelligence can also be seen running through the writings of Cattell, and is perhaps most clearly seen in Spearman's equation of g with "mental energy." (6)

For complex statistical reasons that I have discussed elsewhere, it is possible for the factor analysis of a given set of tests for a given set of subjects to support more than one theory. (7) I have also shown, however, that these "different" theories may all be viewed as special cases of a single theory, with each special case highlighting different aspects of the nature of intelligence. (8) I believe, therefore, that too much has been made of differences among theories in past writings, and not enough of their similarities.

Processes of Intelligence

Until about 1960, research on the nature of intelligence was dominated by the factorial approach to intelligence (which is sometimes called the differential approach or the psychometric approach). The publication in 1960 of two classic works by two different sets of "information-processing psychologists"--Miller, Galanter, and Pribram, and Newell, Shaw, and Simon--initiated a change in emphasis from research seeking to factor analyze the products of test performance to research seeking to isolate the processes of test performance. (9) By the 1970's, the information-processing approach was firmly entrenched in the study of intelligence. The adoption of the information-processing approach has not necessitated the rejection of what we learned from factor analysis. Rather, information-processing psychologists have sought to supplement our understanding of the factors of intelligence with an understanding of the processes that are responsible at

least in part for the generation of these factors as sources of individual differences. Examples of processes include encoding stimulus information, inferring relations between stimuli, and applying these relations to new contexts.

A number of different information-processing theories and methods have been proposed by researchers such as Jack Carroll, Earl Hunt, Arthur Jensen (whose work on information processing can and should be distinguished from his work on group differences in intelligence), James Pellegrino and Robert Glaser, Richard Snow, and myself. (10) These theories are similar in their postulation of sets of basic processes that are proposed to be used in intelligent information processing. They differ in the identities of the processes, the complexity of the processes, and the tasks from which the processes are isolated and which are alleged to measure intelligent performance. The tasks range in complexity from choice reaction time to complex reasoning problems. For example, in Hunt's theory, individual differences in verbal ability are understood in terms of people's differential rates of access to highly overlearned information stored in memory. In my own theory, individual differences in verbal ability are understood in terms of people's differential incidental learning of new concepts presented in everyday contexts.

It is not possible in the space allotted here to do justice to all of these theories, or even to describe any of them in great detail. I will, however, present the bare bones of my favorite theory, my own.

Whereas factorial theories use the factor (e.g., verbal comprehension, spatial visualization, and the like) as the unit of analysis, my theory and certain other information-processing theories use as the unit of analysis the component. Whereas a factor can be any kind of underlying source of individual differences, a component is an elementary information process that operates upon internal representations of objects or symbols. It should be emphasized that what is called "elemen-

tary" in one theory might be called "complex" in another: A component is elementary or complex with respect to the level of behavior a given theory is attempting to account for. A component may translate a sensory input into a conceptual representation, transform one conceptual representation into another, or translate a conceptual representation into a motor output. (11)

Components of intelligence can be subdivided on the basis of the functions they perform in intelligent problem solving. The subdivision is basically a matter of a given theorist's choice, and must be evaluated for its plausibility. Consider the possible form this subdivision takes in my own theory.

Components can be distinguished on the basis of function into five different kinds: metacomponents, performance components, acquisition components, retention components, and transfer components. The functions of these kinds of components will be illustrated in the context of their possible application to the solution of analogy problems.

Metacomponents are higher-order control processes used for executive planning and decision-making in problem solving. In an analogy problem, for example, one needs to (a) decide just what kind of answer the problem requires--multiple-choice, fill-in, or whatever; (b) select the inductive operations that are needed to solve an analogy; (c) decide upon an order in which the inductive or other operations should be applied; (d) decide whether to represent information contained in the terms of the analogy using a list of attributes, a multidimensional imaginal space, or whatever; (e) decide how much time can be allotted to a given analogy; and (f) monitor how well one is progressing toward finding the best of several analogy completions.

Bill Salter and I have collected data in which we have isolated two metacomponents of strategy selection (_c_ in the above list) that we refer to as global planning and local planning. The metacomponents were isolated by mathematical

modeling of response time data in a complex analogical-reasoning test. (12) Global planning is applied to a set of problems that needs to be solved (e.g., an analogies subtest on an IQ test) and is heavily influenced by the context in which the problems are presented; but it is uninfluenced by the particulars of individual problems within the set. Local planning is applied to individual problems within a set, rather than to the set of problems as a whole. For very complex analogies, we have found that individuals with higher scores on a psychometric test of reasoning ability tend to spend more time than individuals with lower scores on global planning, but less time on local planning. The brighter individuals, in other words, seem to do more of their planning "up front" in performing a task.

Performance components are processes used in the execution of strategies for task performance. Performance components may be viewed as executing the plans and implementing the decisions laid down by the metacomponents.

My collaborators and I have isolated performance components from a number of different tasks by mathematical modeling of reaction time and error data. In an analogies task, it has been found that individuals with higher scores on psychometric tests of reasoning ability tend to spend more time in encoding the terms of an analogy than do individuals with lower scores, but less time in combining and comparing terms, and in responding. This pattern of results is quite compatible with the metacomponential pattern of results noted above. Brighter individuals spend relatively more time in preparing for (combination and comparison) operations that act upon encodings of analogy stimuli, but relatively less time in actually executing these operations.

Acquisition components are processes involved in learning new information; retention components are processes involved in retrieving information that has been previously acquired; and transfer components are processes involved in carrying over retained information from one situational context to another. Our research has not

yet reached the point where we are able to specify what these processes are.

How does this information-processing conception of intelligence relate to the definitional conceptions we considered, on the one hand, and to the factorial ones, on the other? In typical testing situations, the measurement of crystallized ability involves, for the most part, *accumulated products of past executions* of components of acquisition, retention, and transfer. In tests of vocabulary and general information, for example, and to a lesser extent, in tests of reading comprehension, the major determinant of individual differences will be knowledge acquired well before the test was ever taken. In contrast, the measurement of fluid ability involves, for the most part, current execution of components of performance. The components of reasoning required for the solution of items such as figural analogies, series completions, and classifications are executed at the time the test is actually taken.

Viewed in terms of the themes described in the section on definitions of intelligence, operations of acquisition, retention, and transfer components determine to a large extent one's ability to learn or profit from experience, and the knowledge actually acquired from experience; operations of performance components are largely responsible for an individual's abstract thinking or reasoning ability; and the metacomponents drive the components of all the other kinds. The metacomponents may be seen as the motivational element in the present theory, akin in some way to Spearman's concept of "mental energy." What is missing from this account, as from the factorial account, is any firm handle on practical problem solving and adaptation to real-world environments. We are currently attempting to apply my method of componential analysis to simulations of real-world task performance, and are hoping thereby to attain some understanding of how people carry out consequential actions in their everyday encounters with the environments in which they find themselves.

Deficiencies of Intelligence

Numerous investigators have sought to understand the nature of intelligence by assessing what it is that mentally retarded individuals lack. A number of different approaches have been taken to understanding the nature of mental retardation, but three approaches are of particular interest to us here.

A first approach, identified with investigators such as John Belmont, John Borkowski, Ann Brown, Earl Butterfield, Joseph Campione, Norman Ellis, and David Zeaman, seeks to understand mental retardation in terms of ineffective functioning of what were called above acquisition, retention, and transfer components, and particularly, in the interaction between these kinds of components and metacomponents, or control processes. (13) It has been possible in some of the research using this approach to effect dramatic improvements in the learning and recall performance of retarded individuals by training these individuals in strategies for rehearsing items recently presented in word lists, strategies for organizing the words on these lists in a way that makes them easier to recall (e.g., by semantic category membership), strategies for apportioning study time during learning, and the like. In terms of the factorial language, subjects may be viewed as having been trained in skills that lead to improved crystallized ability. In terms of the language of the definitional approach, subjects may be viewed as having been trained to learn or profit from experience.

A second approach, identified with investigators such as Milton Budoff, Carl Bereiter, Sigfried Engelmann, and Reuven Feuerstein, seeks to understand mental retardation in terms of ineffective functioning of what were called above performance components, and particularly, in the interaction between this kind of component and metacomponents. (14) Improvements in performance on IQ tests have been attained through the use of training based upon this approach. Feuerstein's instrumental enrichment program is probably the largest-scale program of this kind, and the results of using it have been highly favorable. In terms of the factorial language,

subjects may be viewed as having been trained in fluid ability skills. In terms of the language of the definitional approach, subjects may be viewed as having been trained in abstract reasoning and thinking skills.

A third approach, identified primarily with Edward Zigler, seeks to understand mental retardation at least partly in terms of motivational variables that operate differently in normal and retarded individuals. (15) Zigler has not claimed that mental retardation should be understood primarily as some kind of motivational deficiency. Rather, he has suggested that in order to understand fully the effects of cognitive deficiencies, one must understand how the effects of cognitive variables are mediated by motivational ones. By effecting quantitative and qualitative changes in the motivational levels of retarded children, Zigler and his colleagues have been able to obtain large improvements in these children's performance on traditional cognitive tasks. I believe that Zigler has persuasively shown that the motivational component running through the notions of intelligence considered earlier is important as well in understanding one source of deficient performance in mentally retarded individuals.

No one seems to have proposed an approach to understanding mental retardation in terms of ineffective functioning in real-world environments (although the motivational approach comes close to this in some respects), and with good reason. Mildly retarded individuals, those who have been by far the most widely studied, function surprisingly well in real-world settings. Indeed, mild retardation seems primarily to be an academic problem and hence a childhood problem. Once the individual's primary adaptation is to spheres other than academic ones, there are any number of societal roles in which he or she can function effectively.

Conclusions

On the basis of the review conducted above, I am prepared to suggest that any fully adequate theory or measure of intelligence needs to take into account at least

four macrocomponents of intellectual performance. I am inclined to refer to them as "macrocomponents" in order to distinguish them from the "microcomponents" I described earlier in presenting my own theory of intelligence. The four macrocomponents are:

1. Ability to learn and profit from experience and the products of this experience (also referred to earlier as crystallized ability and as the functioning and products of acquisition, retention, and transfer components as driven by metacomponents). An intelligent person learns from his or her interactions with the environment, and uses his or her experience to greater advantage than does a less intelligent person. As a result, the intelligent person tends to know more (except in cases of deprivation of an individual in his or her interactions with the environment, in which cases the opportunities to learn are simply not presented to the individual).

2. Ability to think or reason abstractly (also referred to earlier as fluid ability and as the functioning of performance components as driven by metacomponents). An intelligent person can infer relations between events, apply these relations to new situations, integrate information, and otherwise exploit given and inferred information to greater advantage than can a less intelligent person.

3. Ability to adapt oneself to the vagaries of a changing and uncertain real-world environment. An intelligent person is a better practical problem solver than is a less intelligent person. He or she is better able to cope with the challenges that life presents. In making a decision as to whether to consummate an important purchase, for example, such a person is likely to consult more sources of information, to consult in particular those sources of information that are most likely to contain critical information, to evaluate and integrate the information that is acquired in a more careful manner, and to investigate more fully the alternatives that are available, such as the purchase of a competing product, or the purchase of no product at all.

4. Ability to motivate oneself to accomplish expeditiously the tasks one needs to accomplish. An intelligent person is more highly motivated than an unintelligent one to accomplish the things that matter for successful adaptation to his or her environment. Such a person expresses more of an orientation toward task accomplishment.

In distilling the findings of four approaches to intelligence in order to identify the macrocomponents that are common to all or almost all of them, I have of course been selective in my inclusion of information, and biased in my interpretation of the information I have included. Whether or not my selections and biases have been unfair is a matter for my readership and my peers in the field to judge. Like all investigators, I would like to believe that I have been reasonable and fair. One possibly promising sign that I have indeed been reasonable and fair is that there is nothing nonobvious about the four macrocomponents I have listed; to the contrary, they are abilities that people in various walks of life have for many years asserted to be integral parts of intelligence. Indeed, that is how they got on the list! To the extent that these four items do seem to emerge in research on intelligence, almost without regard to the approach that is used, one's confidence in their importance to a theory of intelligence increases.

Since the majority of investigators of intelligence switched their allegiance from the factorial approach (upon which IQ tests were originally based) to the information-processing approach, we have learned a lot about certain aspects of intelligent behavior. Consider, for example, the analogy problem that is so frequently found on tests of intelligence. Before the information-processing analysis of analogy task performance, we knew little more than that the analogy was a very good measure of fluid ability. We now know (a) the component processes people use in solving analogies, (b) the various strategies into which these processes combine in order to form a working procedure for solution, (c) upon what kinds of internal

representations for information these component processes and strategies act, (d) approximately how much time is spent on each component process for analogies of different kinds, (e) approximately how likely each of these processes is to be executed accurately, (f) which component processes are responsible to what degree for the analogy's usefulness as a measure of fluid ability, and quite a bit more. We also know how individuals differ in these various aspects of information processing, both within and across age levels. (16)

The knowledge we have gained from intensive information-processing analysis of problems found on IQ tests convinces me that contemporary theories of intelligence are quite adequate in their accounts of the first two macrocomponents listed above. But they are wholly inadequate in their accounts of the last two macrocomponents. If we return to the question posed at the beginning of the article regarding the relationship between natural intelligence and measured intelligence, we find that what IQ tests measure pretty much reflects the current state of theory, regardless of the approach motivating the theory. Intelligence tests are quite strong in their measurement of the first two macrocomponents in the list, but quite weak in their measurement of the last two macrocomponents. Note that factorial and information-processing theories have essentially the same patterns of strengths and weaknesses in this respect: A change from measurement of factors to measurement of microcomponents will not alter the essential coverage of the tests, because the items that have been analyzed via the two kinds of techniques are almost the same. Indeed, I have argued here and elsewhere in detail that the ground covered by factorial and information-processing theories is almost identical. (17)

I do not have any doubt that the motivation required to perform well on IQ tests will provide at least some indication of the motivation an individual has to perform in more typical kinds of situations; nor do I have any doubt that the ability to solve the often somewhat obscure kinds of problems presented on these tests will correlate in some small degree with the ability to solve problems in the

real world. But the measurement of these abilities provided by IQ tests is minimal and certainly less than adequate. Problems such as those both factorial and information-processing investigators have studied can measure only a small subset of the skills that contribute to intelligent behavior. People have tried before to measure motivational and practical problem solving abilities, and they have met with some success, at least in the motivational domain. (18) But I believe we need to redouble these efforts, despite the frequent frustrations with which they have met in past research. Our present policy in research on intelligence--to direct almost all of our efforts toward further understanding and better measurement of those abilities that we have been most successful in understanding and measuring in the past--is an understandable one. This policy has been productive in the past, and I expect it will continue to be productive in the future, at least in the short run. It is not likely to be the most productive policy to follow in the long run, however. I and many others believe we have pretty much reached a ceiling on what we can do with the kinds of tests we presently have. As I stated above, changing the forms of the scores from factorial to information-processing ones will not change the limitations inherent in the narrow range of abilities we are presently studying. In order to improve our measurement of intelligence and our theories of what gives rise to scores on these measurements, we need to supplement what we have, both in terms of measurement and theory. Perhaps we will have to accustom ourselves to experiencing more failures in meeting our short-term goals in order, hopefully, to experience more successes in eventually meeting our long-term goals. These goals would seem to include as an essential part the understanding and measurement of intelligence in the fullest sense of the term, rather than in a narrow and restrictive one. (19)

Notes

1. "Intelligence and its Measurement: A Symposium," *Journal of Educational Psychology* 12 (1921): 123-147, 195-216, 271-275.

2. Robert J. Sternberg, Barbara E. Conway, Jerry L. Ketron, and Morty Bernstein, "People's Conceptions of Intelligence" (submitted for publication).

3. Charles Spearman, "'General Intelligence,' Objectively Determined and Measured," *American Journal of Psychology* 15 (1904): 201-93.

4. Raymond B. Cattell, *Abilities: Their Structure, Growth, and Action* (Boston: Houghton-Mifflin, 1971); John L. Horn, "Organization of Abilities and the Development of Intelligence," *Psychological Review* 75 (1968): 242-59; Philip E. Vernon, *The Structure of Human Abilities* (London: Methuen, 1971).

5. J. P. Guilford, *The Nature of Human Intelligence* (New York: McGraw-Hill, 1967); Daniel P. Keating, "The Search for Social Intelligence," *Journal of Educational Psychology* 70 (1978): 218-23.

6. Cattell, *Abilities: Their Structure, Growth, and Action*; Charles Spearman, *The Abilities of Man* (New York: Macmillan, 1927).

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19. Preparation of this article was supported by Contract N0001478C0025 from the Office of Naval Research to Robert J. Sternberg.

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